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XII.

Latitudes and Longitudes of Several Places in the United States, as determined by Observation.

BY ROBERT T. PAINE, A. A. S.

IN the autumn of 1831, being about to set out on a journey to some of the Southern States, it occurred to me that a favorable opportunity presented itself for attempting to determine the latitude and longitude of the places I might pass through, when the time and the weather would permit. I therefore provided myself with a sextant of the manufacture of Parkinson and Frodsham, graduated to 10", and the same that was used by me in an observation, at Monomoy Point Lighthouse, of the annular * eclipse of February, 1831; an artificial horizon of mercury, the glasses in the skreen of which had been carefully examined; and a pocket chronometer made by Barraud, which was highly recommended for being but little affected by the motion of a carriage or of the body.

The result of the observations made on my journey with these instruments, I now have the pleasure of communicating.

It was quite impossible to measure, satisfactorily, a single

* A memoir of this remarkable eclipse is in preparation and will appear in the ensuing volume.

altitude in the city of New York, at any hour of the day; and in Philadelphia the motion of vehicles permitted of the admeasurement of only one, when the sun was on, or very near, the meridian; in the afternoon, however, this difficulty was not often experienced there, so that, in general, observations for the error of the chronometer could easily be made.

The latitude of each place was deduced from each altitude; and the result thereof is stated. No observation was in any instance rejected. For the longitude, the rate of the chronometer was depended on, with one exception only, for not more than two days. The chronometer, as has already been mentioned, was but little affected by motion; when, however, it had been carried over the rough roads of Virginia, it exhibited a tendency to accelerate, but so uniformly as not to impair its usefulness; thus at Philadelphia, at Norfolk, and during the first week of my residence in Richmond, it gained one second daily; during the second week 1.5 second, while I was absent in the interior of Virginia 2.1 seconds; at Washington and Baltimore 2.7 seconds; and in Philadelphia, New York, and Providence, 3.1 seconds.

On account of the inclemency and tempestuousness of the weather after the 21st of November (the beginning of the winter), the number of observations I was enabled to make at Washington and Baltimore was smaller than was desired; nevertheless the results of them are now submitted, with the hope that future observations will show them to be close approximations to the truth.

It may be proper to remark, that Doctor Young's Refractions, corrected for the altitude of the barometer and thermometer, were used in the reductions.

OBSERVATIONS.

At Philadelphia, at a place about 150 feet S. E. of Independence Hall, 1831, Oct. 14th, observed the meridian alt. of the Sun ;

resulting latitude	39° 56' 58.2"
Latitude of the Hall by this observation	39 56 59

At Norfolk, at a place about 50 feet south of the Farmer's Bank.

For the Latitude.

Oct. 31st, observed 18 altitudes of the Sun, upon or near the meridian ;
resulting latitudes,

36° 50' 32.5" ; 40.9" ; 38.7" ; 49.0" ; 39.4" ; 48.7" ; 45.4" ; 41.1" ; 40.3"	
" " 42.2 ; 39.1 ; 48.0 ; 58.7 ; 64.7 ; 72.5 ; 61.0 ; 71.1 ; 60.5	
Mean of the 18 observations	36° 50' 49.6"
Therefore, the latitude of the Bank is	36 50 50.

For the Longitude.

<i>Oct. 29th. Chronometer fast of mean time at Norfolk</i>	<div>h. m. sec. 0 18 48.8</div>
<i>" 26th. At Philadelphia, the Chronometer too fast for mean time 14' 14.6" ; adding the daily rate + 1.0" makes it too fast Oct. 29th, at Philadelphia,</i>	<div>0 14 17.6</div>
Difference of meridians	<div>0 4 31.2</div>
Longitude of Independence Hall, Philadelphia,	<div>5 0 43.9</div>
Longitude of Farmer's Bank, Norfolk,	<div>5 5 15.1</div>

The long. of the Navy-yard at Gosport (1½ English miles S. 9° W.) was determined by observations of the beginning and end of the eclipse of Feb. 12th 1831, to be

	<div>h. m. sec. 5 5 19.0</div>
Therefore the longitude of Farmer's Bank by this eclipse is	5 5 18.0

In the great map of the state of Virginia, the longitude of the "south end" of Norfolk is said to have been ascertained to be 44° 5" (2 56.3) east of the Capitol, at Washington, the position of which has been found, by observations on the annular eclipses of 1791, 1811, and 1831, to be

	<div>h. m. sec. 5 8 7.2</div>
Therefore long. of the "south end" of Norfolk by the map	5 5 10.9

At Richmond, at a place about 450 feet S. 25° E. of the Capitol.

For the Latitude.

1831, Nov. 3d. Observed 13 altitudes of the Sun upon or near the meridian; resulting latitudes,

37° 31' 87.4"; 72.5"; 72.7"; 76.5"; 75.5"; 71.0"; 66.8"; 65.3"; 80.4"

" " 79.5; 87.5; 59.4; 56.5. Mean of the 13 obs. 37° 32' 13.2"

Nov. 5th. Observed 18 altitudes of the Sun upon or near the meridian; resulting latitudes,

37° 32' 17.4"; 5.3"; 20.9"; 12.2"; 8.8"; 11.3"; 5.6"; 16.5"; 12.8"

" " 19.8; 21.9; 9.7; 17.5; 9.9; 14.2; 15.0; 13.6; 4.0

Mean of the 18 and of the 31 37° 32' 13.2"

The reduction to the Capitol is + 3.8

Hence the latitude of the Capitol is 37° 32' 17".

For the Longitude.

Nov. 2d. Chronometer fast of mean time at Richmond	h. m. sec. 0 23 27.0
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" Chronometer fast of mean time at Norfolk, same day,	0 18 52.6
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Difference of meridians	0 4 34.4
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Longitude of Norfolk, as above	5 5 15.1
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Longitude of Richmond	5 9 49.5
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2dly. Chron. fast of mean time at Richmond, Nov. 18th,	0 23 35.7
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Chronometer fast of mean time at the Observatory of the

University of Virginia, the same day,	0 27 52.0
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Difference of meridians	0 4 16.3
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Long. of the Observatory by eclipses of 1791, 1811, and 1831,	5 14 5.9
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Longitude of Richmond	5 9 49.6
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3dly. Chronometer fast of mean time at a house in

F street, Washington, Dec. 8th,	0 22 44.2
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Chronometer fast of mean time at Richmond, the same day	0 24 21.9
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Difference of meridians	0 1 37.7
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Longitude of the house in F street 5.1^{sec.} W. 28" N. of the

Capitol	5 8 12.3
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Longitude of Richmond	5 9 50.0
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Mean of the three estimates, increased by the reduction to the

Capitol in Richmond ($0.2^{\text{sec.}}$) is h. m. sec.
5 9 49.9

In the table of geographical positions, on the map before mentioned, the difference of longitude of the two Capitols is said to be $25' 54''$ ($1^{\text{m.}} 43.6^{\text{sec.}}$) "as determined from astronomical observations." Hence the long. of the Capitol in Richmond is $5^{\text{h.}} 8^{\text{m.}} 7.2^{\text{sec.}} + 1^{\text{m.}} 43.6^{\text{sec.}}$ or $5^{\text{h.}} 9^{\text{m.}} 50.8^{\text{sec.}}$, which differs but little from the preceding.

At the dwelling-house at Montpelier, the seat of James Madison, late President of the United States.

For the Latitude.

1831, Nov. 24th. Observed 19 altitudes of the Sun upon or near the meridian; resulting latitudes,

$38^{\circ} 12' 54.8''$; $57.5''$; $66.0''$; $55.2''$; $56.8''$; $62.5''$; $47.2''$; $36.0''$; $53.7''$
 54.7 ; 60.5 ; 50.5 ; 43.5 ; 61.1 ; 63.9 ; 63.3 ; 67.6 ; 56.3
 53.0 ;

Mean of the 19 observations $38^{\circ} 12' 55.9''$

For the Longitude.

Nov. 24th. Chronometer fast of mean time at Montpelier h. m. sec.
0 27 1.9
 Chronometer fast of mean time at the University of Virginia,
 the same day, 0 28 6.7

Difference of meridians 0 1 4.8

Longitude of the University Observatory 5 14 5.9

Longitude of Montpelier 5 13 1.1

At Washington, at a house in F street, exactly east of the President's House.

For the Latitude.

Dec. 8th. Observed 2 altitudes of the Sun upon or near the meridian; resulting latitudes,

$38^{\circ} 53' 22.5''$; $21.1''$. Mean of them $38^{\circ} 53' 21.8''$ — reduction to the latitude of the Capitol = latitude of that building $38^{\circ} 52' 54''$

At Baltimore, at a place about 100 feet S. S. W. of the Battle Monument.

For the Latitude.

1831, Dec. 23d. Observed 10 altitudes of the Sun upon or near the meridian ; resulting latitudes,

39° 16' 94.5'' ; 44.5'' ; 70.3'' ; 66.2'' ; 77.4'' ; 62.4'' ; 89.7'' ; 65.3''
69.4 ; 73.7.

Mean of the 10 observations 39° 17' 11.3''

Dec. 25th. Observed Sun's meridional alt. ; resulting lat. 9.5

“ 26th. Observed Sun's meridional alt. ; resulting lat. 24.1

Mean of the 12 observations 39 17 12.3

Therefore, the latitude of the Battle Monument is 39 17 13.

For the Longitude.

Chronometer fast of mean time at Baltimore, Dec. 24th,

h.	m.	sec.
0	21	47.7

Chron. fast of mean time in F street, Washington, same day,

0	23	28.1
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Difference of meridians

0	1	40.4
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Longitude of the house in F street, Washington

5	8	12.3
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Longitude of Baltimore

5	6	31.9
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2dly. Chro. fast of mean time at Philadelphia, Dec. 29th.

0	16	13.4
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Chronometer fast of mean time at Baltimore, the same day,

0	22	1.2
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Difference of meridians

0	5	47.8
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Long. of Philadelphia (No. 102, Chesnut street, near 3d street)

5	0	43.0
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Longitude of Baltimore

5	6	30.8
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The mean of the two (5h. 6' 31.3'') may be taken as the longitude of the Battle Monument.

At Brooklyn, 5000 feet South, 1 statute mile East, of the City Hall, New York.

For the Longitude.

Chronometer fast of mean time by Transit clock, Jan. 9, 1832,

m.	sec.
12	2.5

Chronometer fast of mean time at Philadelphia, the same day

16	47.0
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Difference of meridians

4	44.5
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	h.	m.	sec.
Longitude of Philadelphia, as above	5	0	43.0
Longitude of Brooklyn	4	55	58.5
By two observations on the eclipse of <i>Feb.</i> 12, 1831, :	4	55	57.2

At Providence, at the Old College, Brown University.

For the Latitude.

1832, *Jan.* 14th. Observed 47 altitudes of the Sun upon or near the meridian ; resulting latitudes,

41° 49' 26.0'' ; 20.1'' ; 20.4'' ; 26.9'' ; 23.3'' ; 23.6'' ; 29.3'' ; 35.1''
34.1 ; 34.7 ; 28.1 ; 34.6 ; 31.4 ; 27.4 ; 26.3 ; 35.0
34.6 ; 35.0 ; 35.5 ; 37.7 ; 36.0 ; 31.2 ; 27.5 ; 28.5
29.8 ; 20.3 ; 16.8 ; 7.0 ; 1.1 ; 3.4 ; 8.0 ; 3.3
23.1 ; 30.3 ; 28.0 ; 26.0 ; 23.5 ; 20.2 ; 18.9 ; 31.4
19.4 ; 25.2 ; 21.4 ; 23.4 ; 23.5 ; 27.1 ; 19.2.

Mean of the 47 observations 41° 49' 25.0''

For the Longitude.

	h.	m.	sec.
Chronometer fast of mean time at the College, <i>Jan.</i> 13, 1832,	0	2	1.3
Chronometer fast of the transit clock at Brooklyn, same day,	0	12	15.5
Difference of meridians		10	14.2
Longitude of Brooklyn, as above,	4	55	58.5
Longitude of the Old College, Providence,	4	45	44.3

2dly. Chron. fast of mean time, at Providence, <i>Jan.</i> 16th,	0	2	10.6
Chronometer fast of mean time at Boston, the same afternoon	0	0	41.6
Difference of meridians	0	1	29.0
Longitude of the State-house in Boston	4	44	16.6
Longitude of the Old College, Providence,	4	45	45.6
By observations on the eclipse of <i>Feb.</i> 12, 1831,	4	45	43.7
The mean of the three is	4	45	44.5